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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|---|---|---|---|---|
| 10/087,741 | 03/05/2002 | Sang-Hyuck Ahn | 61610013AA | 7018 |

58027 7590 06/16/2006

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| EXAMINER | |
|---|---|
| DONG, DALEI | |

| ART UNIT | PAPER NUMBER |
|---|---|
| 2879 | |

DATE MAILED: 06/16/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/087,741 | AHN ET AL. | |
| | Examiner | Art Unit | |
| | Dalei Dong | 2879 | |

*-- Th MAILING DATE of this communication appears on the cov r sheet with the correspondenc address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *05 June 2006*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) 1-15 is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-15* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *05 March 2002* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date: _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

## DETAILED ACTION

1. The Amendment filed on June 5, 2006, has been entered and acknowledged by the Examiner.

### *Claim Rejections - 35 USC § 102*

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1-4 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent No. 6,436,221 to Chang.

Regarding to claim 1, Chang discloses in Figure 1, a method for fabricating a field emission display, comprising: forming a cathode electrode (20) on a substrate (10); forming an emitter (30) having a carbon-based material (see column 1, lines 33-37) on the cathode electrode (20); depositing an emitter surface treatment agent (adhesive film or polymer film) on the substrate (10) to cover the emitter (30) after forming the emitter (see column 3, lines 55-60); hardening the emitter surface treatment agent (the Examiner interprets that the adhesive film or the polymer film is sufficiently harden when deposited on top of the emitter thus the step of hardening the emitter surface treatment is already accomplished. Furthermore, even if the adhesive film is not harden when deposited,

however, the adhesive film had to be hardened to a sufficient degree in order to be pulled up, thus the Examiner interprets that the step of hardening the emitter surface treatment step is accomplished); and removing the harden emitted surface treatment agent (see column 3, line 60) from the substrate (10) such that the carbon-based material contained in the emitter can be exposed.

Regarding to claim 2, Chang discloses in Figure 1, printing a paste having the carbon-based material (30) on the cathode electrode (20) (see column 1, lines 33-35); and heat-treating the printed paste at a temperature lower than a complete-baking temperature for the paste (see column 3, lines 54-55).

Regarding to claim 3, Chang discloses in Figure 1, the paste (30) is printed through a screen-printing process using a metal mesh screen (see column 1, lines 33-35).

Regarding to claim 4, Chang discloses in Figure 1, the carbon-based material is selected from the group consisting of a carbon nanotube, graphite, and diamond (see column 1, lines 35-37).

### *Claim Rejections - 35 USC § 103*

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person

having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 5, 6, 10, 11 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,436,221 to Chang in view of U.S. Patent No. 6,645,402 to Kurokawa.

Regarding to claim 5, Chang discloses in Figure 1, a method for fabricating a field emission display, comprising: forming a cathode electrode (20) on a substrate (10); forming an emitter (30) having a carbon-based material (see column 1, lines 33-37) on the cathode electrode (20); depositing an emitter surface treatment agent (adhesive film or polymer film) on the substrate (10) to cover the emitter (30) after forming the emitter (see column 3, lines 55-60); hardening the emitter surface treatment agent (the Examiner interprets that the adhesive film or the polymer film is sufficiently harden when deposited on top of the emitter); and removing the harden emitted surface treatment agent (see column 3, line 60) from the substrate (10) such that the carbon-based material contained in the emitter can be exposed.

However, Chang does not disclose the emitter surface treatment agent is deposited through a spin-coating process.

Kurokawa teaches in Figures 3-6, a method for fabricating a field emission display, comprising: depositing the emitter surface treatment agent (20 cc of a solution obtained by diluting isobutyle methacrylate with butyl carbitol along with organic material 6) by spin coating process (see column 18, lines 24-27) for the purpose of realizing a highly efficient electron emitting device by facilitating electron emission.

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have utilize the spin coating process of Kurokawa for

depositing the surface treatment agent of Chang in order to realize a highly efficient electron emitting device by facilitating electron emission.

Regarding to claim 6, Kurokawa teaches in Figures 3-6, the emitter surface treatment agent is hardened by a heat-treatment process (see column 8, lines 55-64) and the motivation to combine is the same as in claim 5.

Regarding to claim 10, Regarding to claim 10, Chang discloses in Figure 1, a method for forming a carbon-based emitter, comprising: forming an emitter (30) including a carbon-based material (see column 1, lines 33-37); forming a surface treatment agent (adhesive film or polymer film) over the emitter (30) after forming the emitter; removing at least a portion of the treatment film (see column 3, lines 55-60).

However, Chang does not disclose heating the surface treatment agent for forming a treatment film.

Kurokawa teaches in Figures 3-6, a method for fabricating a field emission display, comprising: heating the surface treatment agent (20 cc of a solution obtained by diluting isobutyle methacrylate with butyl carbitol along with organic material 6) for forming a treatment film (see column 8, lines 55-64) for the purpose of realizing a highly efficient electron emitting device by facilitating electron emission.

Thus, it would have been obvious to one having ordinary skill in the art at the time the invention was made to have the heating process of Kurokawa for the surface

treatment agent of Chang in order to realize a highly efficient electron emitting device by facilitating electron emission.

Regarding to claim 11, Chang discloses in Figure 1, the carbon-based emitter is used in a field emission display.

Regarding to claim 15, Chang discloses in Figure 1, the carbon-based material includes at least one of carbon nanotube, graphite, and diamond (see column 1, lines 35-37).

6. Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,436,221 to Chang in view of U.S. Patent No. 6,623,720 to Howard.

Regarding to claim 7, Chang discloses in Figure 1, a method for fabricating a field emission display, comprising: forming a cathode electrode (20) on a substrate (10); forming an emitter (30) having a carbon-based material (see column 1, lines 33-37) on the cathode electrode (20); depositing an emitter surface treatment agent (adhesive film or polymer film) on the substrate (10) to cover the emitter (30) after forming the emitter (see column 3, lines 55-60); hardening the emitter surface treatment agent (the Examiner interprets that the adhesive film or the polymer film is sufficiently harden when deposited on top of the emitter); and removing the harden emitted surface treatment agent (see column 3, line 60) from the substrate (10) such that the carbon-based material contained in the emitter can be exposed.

However, Chang does not disclose the emitter surface treatment agent is a polyimide solution.

Howard teaches a method of making a field emission display using carbon nanotubes wherein a sacrificial layer made of polyimide is deposited and then removed to better expose the nanotubes (see column 4, lines 5-10).

Howard also teaches that the removable sacrificial layer (or "surface treatment layer") should be made of a material that does not have detrimental effects to the emissive layer, and teaches that polyimide material is a suitable sacrificial or surface treatment layer.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use polyimide material for the surface treatment because it is non-harmful suitable material for the removable surface treatment layer, as evidenced by Howard.

7. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,436,221 to Chang.

Regarding to claim 8, Chang discloses the claimed fabrication method of claim 2, wherein the printed paste (30) is heat treated at the temperature of about 350-430 degrees Celsius (see column 3, lines 62-65). Chang however, does not explicitly disclose the duration of the sintering process. However, it is well known in the art to heat treat the carbon nanotubes for a few minutes at a such temperature in order to successfully perform curing. Therefore, it would have been obvious to one having ordinary skill in

the art to have heat treated the printed paste of Chang for about two minutes, in order to solidify the CNT on the cathode electrode.

8. Claims 9, 13 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,436,221 to Chang in view of U.S. Patent No. 6,645,402 to Kurokawa and in further view of U.S. Patent No. 6,013,238 to Murata.

Regarding to claim 9, Chang in view of Kurokawa discloses the method of manufacturing a field emission display in claim 6; however, Chang and Kurokawa does not disclose deposit the surface treatment agent located on a hot plate.

Murata teaches in column 13, lines 65-67, makes it clear that the hot plate method is a well-known, conventional method used for heating elements in field emission display. It would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a hot plate instead of the process of heating as disclosed by Kurokawa - since applicant has not shown that any particular advantage comes of using a hot plate at 90 degrees C for 20 minutes versus the method as disclosed by Kurokawa, it is argued that it would have been obvious to use either method as the heat treatment method of the surface treatment agent, since both produce the same result -- curing of the film.

Regarding to claim 13, since applicant has not shown that any particular advantage comes of using a hot plate at 90 degrees Celsius versus the method as disclosed by Kurokawa, it is argued that it would have been obvious to use either method

as the heat treatment method of the surface treatment agent, since both produce the same result -- curing of the film.

Regarding to claim 14, since applicant has not shown that any particular advantage comes of using a hot plate for 20 minutes versus the method as disclosed by Kurokawa, it is argued that it would have been obvious to use either method as the heat treatment method of the surface treatment agent, since both produce the same result -- curing of the film.

9. Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,436,221 to Chang in view of U.S. Patent No. 6,645,402 to Kurokawa and in further view of U.S. Patent No. 6,623,720 to Howard.

Regarding to claim 12, Chang in view of Kurokawa discloses a method for forming a carbon-based emitter, comprising: forming an emitter including a carbon-based material; forming a surface treatment agent over the emitter after forming the emitter; heating the surface treatment agent for forming a treatment film; and removing at least a portion of the treatment film.

However, Chang and Kurokawa does not disclose the surface treatment agent is polyimide solution material.

Howard teaches a method of making a field emission display using carbon nanotubes wherein a sacrificial layer made of polyimide is deposited and then removed to better expose the nanotubes (see column 4, lines 5-10).

Howard also teaches that the removable sacrificial layer (or "surface treatment layer") should be made of a material that does not have detrimental effects to the emissive layer, and teaches that polyimide material is a suitable sacrificial or surface treatment layer.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to use polyimide material of Howard for the surface treatment agent of Chang and heated according to Kurokawa because it is non-harmful suitable material for the removable surface treatment layer.

***Response to Arguments***

10. Applicant's arguments filed June 5, 2006 have been fully considered but they are not persuasive.

In response to Applicant's argument that the Chang reference fails to teach or suggest the step of hardening the emitter surface treatment agent, the Examiner respectfully disagree. The Examiner interprets that the adhesive film or the polymer film of the Chang reference is sufficiently harden when deposited on top of the emitter thus the step of hardening the emitter surface treatment is already accomplished. Furthermore, even if the adhesive film of the Chang reference is not harden when deposited, however, the adhesive film had to be hardened to a sufficient degree in order to be pulled up, thus the Examiner interprets that the step of hardening the emitter surface treatment step is accomplished.

In response to applicant's argument that there is no suggestion to combine the references, the examiner recognizes that obviousness can only be established by combining or modifying the teachings of the prior art to produce the claimed invention where there is some teaching, suggestion, or motivation to do so found either in the references themselves or in the knowledge generally available to one of ordinary skill in the art. See *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) and *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992). In this case, the Chang reference and the Kurokawa reference both teach a electron emitting device utilizing carbon nanotubes. The Kurokawa reference teaches a step of heating the surface treatment agent at 300 degree Celsius for one hour in order to adhere the graphite particles to the chromium electrode. By using the heating process of the Kurokawa reference with the adhesive film of the Chang reference, it will soften the adhesive film and provide higher adherence therefore enhances contact between the adhesive film and the CNT substrate and thus the adhesive film will remove even more badly attached CNT while pulling the buried CNT into a proper direction.

***Conclusion***

11. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dalei Dong whose telephone number is (571)272-2370. The examiner can normally be reached on 8 A.M. to 5 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nimeshkumar Patel can be reached on (571)272-2457. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

D.D.
June 7, 2006

K Guharay
Karabi Guharay
Primary Examiner
Art Unit 2879
6/8/06